REPORT OF AIR POLLUTION SOURCE TESTING OF AN ETHYLENE OXIDE EMISSION-CONTROL SYSTEM OPERATED BY STERIGENICS, INC. IN SALT LAKE CITY, UTAH ON APRIL 19, 2016

Submitted to:

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
Division of Air Quality
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Submitted by:

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Prepared by:

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May 22, 2016



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TEST DATE

April 19, 2016

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1.0 INTRODUCTION

On April 19, 2016, ECSi, Inc. performed air pollution source testing of an ethylene oxide (EtO) emission-control device operated by Sterigenics, Inc. in Salt Lake City, Utah. The control device tested was a Ceilcote packed tower scrubber emission-control system, which is currently used to control emissions from ten EtO sterilizer vacuum pumps. The purpose of the testing program was to demonstrate continued compliance with the conditions established in the Air Quality Permit granted to Sterigenics by the Utah Department of Environmental Quality (UDEQ).



2.0 EQUIPMENT

The EtO gas-sterilization system is comprised of ten commercial sterilizers, which are discharged through liquid-ring vacuum pumps to a new Ceilcote packed tower scrubber emission-control system, ten sterilizer exhaust vents (backvents), which are currently discharged to atmosphere, and fourteen aeration cells, which are discharged to an existing two-stage Advanced Air Technologies (AAT) Safe Cell emission-control system. As an alternative emission-control scenario, the facility also has the capability to discharge the sterilization chamber vacuum pumps to the existing AAT Safe Cell system. If required by the USEPA, all backvents can also be discharged to the scrubber. The gas-sterilization and emission-control equipment consist of the following:

- Six Vacudyne Gas Sterilizers, all Model 810, each comprised of a steam-heated 795 cubic foot interior volume sterilization chamber, a recirculating vacuum pump chamber evacuation system, a backdraft valve, and a fugitive emissions exhaust hood;
- One Vacudyne Gas Sterilizer comprised of a steam-heated 3600 cubic foot interior volume sterilization chamber, a recirculating vacuum pump chamber evacuation system, a backdraft valve, and a fugitive emissions exhaust hood;
- One American Sterilizer Company Gas Sterilizer, Model 1200, comprised of a steam-heated 1133
 cubic foot interior volume sterilization chamber, a recirculating vacuum pump chamber evacuation
 system, a backdraft valve, and a fugitive emissions exhaust hood;
- One Environmental Tectonics Corporation Gas Sterilizer, Model 1035, comprised of a steam-heated
 283 cubic foot interior volume sterilization chamber, a recirculating vacuum pump chamber evacuation system, a backdraft valve, and a fugitive emissions exhaust hood;
- One National Sterilizer Company Gas Sterilizer, comprised of a steam-heated 35 cubic foot interior volume sterilization chamber, a recirculating vacuum pump chamber evacuation system, a backdraft valve, and a fugitive emissions exhaust hood
- Fourteen Aeration Chambers, each comprised of a heated aeration chamber and a chamber exhaust system.



Sterilizer vacuum pump emissions are be controlled by:

• One Ceilcote packed tower chemical scrubber, equipped with: a reaction/interface column, 29' 4" high, 48" in diameter, with a 20' bed of #1 Tellerette packing; a 150 GPM scrubber fluid recirculation system; and two 17,000 gallon reaction/storage tanks.

Aeration emissions are controlled by:

One two-stage Advanced Air Technologies Safe Cell emission-control system, comprised of a
packed-tower chemical scrubber (SC1), equipped with a packed reaction/interface column, a
scrubber fluid recirculation system, and a scrubber fluid reaction/storage tank, and a dry bed
reactor/scrubber (SC2), comprised of a bank of solid-bed reaction vessels, connected in parallel,
installed downstream of SC1 and upstream of a dedicated blower exhaust system.



3.0 TESTING

EtO source testing was conducted in accordance with the procedures outlined in USEPA CFR40, Part 63.365. EtO emissions monitoring was conducted simultaneously at the inlet and outlet of the packed tower scrubber during the first chamber evacuation of the sterilizer exhaust phase of one of the ten currently operating sterilizers. A total of three exhaust-phase test runs were performed.

Exhaust phase testing with one sterilizer discharging to the scrubber at a time represents worst-case conditions for demonstration of control efficiency compliance. At this lower inlet loading, the scrubber must perform at its maximum efficiency to achieve outlet EtO concentrations low enough to demonstrate compliance. One of the larger (795 cubic feet or greater) sterilizers was tested to provide a realistic operational scenario.

During the first chamber evacuation of the exhaust phase, EtO emissions to the inlet of the packed tower scrubber were determined using the Ideal Gas Law and the chamber conditions at the beginning and at the end of the first chamber evacuation. During the first chamber evacuation of the exhaust phase, EtO emissions from the outlet of the packed tower scrubber were determined using direct source sample injection into the GC.

All exhaust phase testing was conducted during normal process load conditions, but with an empty sterilization chamber to facilitate inlet mass calculation and the performance of multiple test runs. The testing program was conducted in accordance with the procedures outlined in the following sections.



4.0 RULE/COMPLIANCE REQUIREMENTS

The EtO gas-sterilization system at Sterigenics was tested to demonstrate compliance with the EPA requirements, as specified in the UDEQ Air Quality Permit. The following requirements must be met:

• The sterilizer exhaust phase (post exposure vacuum pulses) emissions must be vented to control equipment with an EtO emission-reduction efficiency of at least 99 % by weight.

Testing is required to demonstrate compliance with these requirements. Source testing of the packed tower scrubber emission-control device was required initially, and must be performed once every 5 years thereafter.



5.0 TEST METHOD REFERENCE

5.1 INTRODUCTION

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All exhaust phase testing was conducted during normal process load conditions, but with an empty sterilization chamber to facilitate inlet mass calculation and the performance of multiple test runs. The testing program was conducted in accordance with the procedures outlined in the following sections.

Operation and documentation of process conditions was performed by personnel from Sterigenics, Inc. using existing monitoring instruments installed by the manufacturer on the equipment to be tested. In accordance with the procedures established in USEPA CFR40, Part 63, Subpart O, scrubber liquor level was recorded. This parametric monitoring data is attached as Appendix G.



5.2 VOLUMETRIC FLOW MEASUREMENT

Exhaust gas flow at the outlet of the scrubber was determined by 40 CFR 60, Appendix A, Method 2, using an s-type pitot tube and an inclined-oil manometer. Sampling ports were located in accordance with 40 CFR 60, Appendix A, Method 1. The test ports were located far enough from any flow disturbances to permit accurate flow measurement.

Temperature measurements were obtained from a type K thermocouple and thermometer attached to the sampling probe. Exhaust gas composition was assumed to be air and small amounts of water vapor. Water vapor was negligible and, based on previous test data, a value of 2 percent was used for flow calculations.

5.3 CONTROL EFFICIENCY AND MASS EMISSIONS MEASUREMENT

During the first chamber evacuation of the sterilizer exhaust phase, the mass emissions of EtO vented to the inlet of the scrubber were determined using the procedures outlined in CFR40, Part 63.365. This method allows the determination of the mass of EtO vented to the inlet of the scrubber through calculations based on the Ideal Gas Law and using the conditions (pressure, temperature, volume) of the sterilization chamber immediately after it has been charged with sterilant gas, and upon conclusion of the first chamber evacuation of the exhaust phase.

The mass of EtO vented to the inlet of the scrubber during the first chamber evacuation of the exhaust phase was determined by calculating the mass of EtO present in the chamber after the first chamber evacuation and subtracting it from the mass of EtO present in the chamber after it had been charged with sterilant gas. The mass of EtO present in the chamber was calculated using Equation 1, shown below in Section 5.9.

During the first chamber evacuation of the sterilizer exhaust phase, EtO emissions from the outlet were determined using direct source sample injection into the GC. The mass of EtO emitted from the outlet was determined using Equation 2, shown below in Section 5.9. Mass-mass control-efficiency of EtO during the sterilizer exhaust phase was calculated by comparing the mass of EtO vented to the system inlet to the mass of EtO vented from the system outlet.

During the sterilization chamber exhaust phase, vented gas was analyzed by an SRI, Model 8610, portable gas chromatograph (GC), equipped with the following: dual, heated sample loops and injectors; dual

columns; and dual detectors. A photoionization detector (PID) was used to quantify low-level EtO emissions at the packed tower scrubber outlet.

5.4 SAMPLE TRANSPORT

Source gas was pumped to the GC at approximately 500-1000 cubic centimeters per minute (cc/min) from the sampling ports through two lengths of Teflon[®] sample line, each with a nominal volume of approximately 75 cubic centimeters (cc) and an outer diameter of 0.25 inch. At the outlet of the scrubber the sampling ports were located in the exhaust stack.

5.5 GC INJECTION

Source-gas samples were then injected into the GC which was equipped with two heated sampling loops, each containing a volume of approximately 2cc and maintained at 100 degrees Celsius (C). Injections occurred at approximately one-minute intervals during the sterilization chamber exhaust phase. Helium was the carrier gas for the PID.

5.6 GC CONDITIONS

The packed columns for the GC were both operated at 80 degrees C. The columns were stainless steel, 6 feet long, 0.125 inch outer diameter, packed with 1 percent SP-1000 on 60/80 mesh Carbopack B.

Any unused sample gas was vented from the GC system back to the inlet of the scrubber.

5.7 CALIBRATION STANDARDS

The PID was calibrated for low-range ppmv level analyses using gas proportions similar to the following:

- 1) 100 ppmv EtO, balance nitrogen
- 2) 50 ppmv EtO, balance nitrogen (audit gas)
- 3) 10 ppmv EtO, balance nitrogen
- 4) 1 ppmv EtO, balance nitrogen



Each of these calibration standards was in a separate, certified manufacturer's cylinder. Copies of the calibration gas laboratory certificates are attached as Appendix F.

5.8 SAMPLING DURATION

Exhaust phase EtO measurements were taken for the entire duration of the first chamber evacuation, which was approximately 15 minutes. This encompassed a total sampling duration of approximately 15 minutes for each exhaust phase test run.

5.9 CONTROL-EFFICIENCY/MASS-EMISSIONS CALCULATIONS

The following equation was used to calculate mass of EtO discharged to the inlet of the emission-control system during the first chamber evacuation of the sterilizer exhaust phase:

EQUATION 1:

 $W_c = W_{ci} - W_{cf}$

Where:

W_c = Weight of EtO discharged from the sterilization chamber to the emission-control system during the first chamber evacuation, pounds

 $W_{ci} = (mw)(p)(P)(V)/(R)(T)$

(and W_{cf})

Where:

W_{ci} = Weight of EtO present in the sterilization chamber before the first chamber evacuation, pounds

W_{cf} = Weight of EtO present in the sterilization chamber after the first chamber evacuation, pounds

MW = Molecular weight of EtO, 44.05 lb/mol

p = Percent of EtO in chamber

= W_s/W_i

Where:

W_s = Scale-measured weight of EtO charged into sterilization chamber

W_i = Calculated weight of EtO charged into sterilization chamber (@ 100%)

P = Sterilization chamber pressure (after charging/at the end of the 1st evac), psia



V = Sterilization chamber volume, ft³

 $R = Gas constant, 10.73 psia ft^3/mol^\circ R$

T = Sterilization chamber temperature (after charging/at the end of the 1st evac), °R

Note: Standard conditions are 68°F and 1 atm.

Mass emissions of EtO during the exhaust phase were calculated using the following equation:

EQUATION 2:

MassRate = $(VolFlow)(MolWt)(ppmv EtO/10^6)/(MolVol)$

Where:

MassRate = EtO mass flow rate, pounds per minute

VolFlow = Corrected volumetric flow rate, standard cubic feet per minute at 68 degrees F

MolWt = 44.05 pounds EtO per pound mole

ppmv EtO = EtO concentration, parts per million by volume

10⁶ = Conversion factor, ppmv per "cubic foot per cubic foot"

MolVol = 385.32 cubic feet per pound mole at one atmosphere and 68 degrees F

Results of the control-efficiency testing are presented in Section 8.0 and in Table 1.



6.0 TEST SCENARIO

During exhaust phase testing, each sterilizer was tested during normal process load conditions, but with an empty sterilization chamber to facilitate the performance of multiple test runs. A total of three exhaust-phase test runs were performed to verify the performance of the emission-control device. Testing was conducted with an effort to offer minimal disruption to the Sterigenics production schedule. The testing schedule was as follows:

- 1) Testing equipment was set up and calibrated.
- 2) An empty-chamber cycle was started in one of the larger (795 cubic feet or greater) sterilizers. This sterilizer was isolated for test use and designated as a test chamber.
- 3) Exhaust Phase Test Run #1 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the Ceilcote scrubber.
- 4) An empty-chamber cycle was started in another of the larger (795 cubic feet or greater) sterilizers.

 This sterilizer was isolated for test use and designated as a test chamber.
- 5) Exhaust Phase Test Run #2 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the Ceilcote scrubber.
- 6) An empty-chamber cycle was started in another of the larger (795 cubic feet or greater) sterilizers. This sterilizer was isolated for test use and designated as a test chamber.
- 7) Exhaust Phase Test Run #3 was conducted. Sampling was performed at outlet of the scrubber during the first chamber evacuation of the test chamber. During the performance of the test, only the sterilizer used for the test was allowed to discharge to the Ceilcote scrubber.
- 8) Post calibration check was performed, testing equipment was packed.



7.0 QA/QC

7.1 FIELD TESTING QUALITY ASSURANCE

At the beginning of the test, the sampling system was leak checked at a vacuum of 15 inches of mercury. The sampling system was considered leak free when the flow indicated by the rotameters fell to zero.

At the beginning of the test, a system blank was analyzed to ensure that the sampling system was free of EtO. Ambient air was introduced at the end of the heated sampling line and drawn through the sampling system line to the GC for analysis. The resulting chromatogram also provided a background level for non-EtO components (i.e. ambient air, carbon dioxide, water vapor) which are present in the source gas stream due to the ambient dilution air which is drawn into the emission-control device, and due to the destruction of EtO by the emission-control device which produces carbon dioxide and water vapor. This chromatogram, designated AMB, is included with the calibration data in Appendix A.

7.2 CALIBRATION PROCEDURES

The GC system was calibrated at the beginning and conclusion of each day's testing. Using the Peaksimple II analytical software, a point-to-point calibration curve was constructed for each detector. A gas cylinder of similar composition as the calibration gases, but certified by a separate supplier, was used to verify calibration gas composition and GC performance.

All calibration gases and support gases used were of the highest purity and quality available. A copy of the laboratory certification for each calibration gas is attached as Appendix F.



8.0 TEST RESULTS

The Ceilcote scrubber demonstrated an EtO control efficiency of 99.999996 percent. In accordance with EPA requirements, as specified in the UDEQ Air Quality Permit, this control equipment must have an EtO control efficiency of 99 percent or more during the sterilizer exhaust phase (vacuum pump emissions). The emission-control device met this requirement.

The test results are summarized in Table 1. These tables include results for EtO control efficiency of the emission-control device. Chromatograms and chromatographic supporting data are attached as Appendices A through D. Copies of field data and calculation worksheets are attached as Appendix E.



TABLES



TABLE 1 ETHYLENE OXIDE CONTROL EFFICIENCY OF A CEILCOTE PACKED TOWER SCRUBBER EMISSION CONTROL DEVICE OPERATED BY STERIGENICS, INC.

IN SALT LAKE CITY, UTAH APRIL 19, 2016

<u>Run #</u>	Stack Flow (dscfm) (2)	Average Outlet Conc. (ppm) (1)	Outlet EtO Mass Flow (lbs/min) (3)	Minutes/ Cycle	Outlet EtO Mass Emissions (lbs)	Inlet EtO Mass Emissions (lbs)	EtO Control Efficiency (%)
#1	141	0.0100	0.0000002	9	0.0000015	41.1	99.999996
#2	140	0.0100	0.0000002	11	0.0000018	39.9	99.999996
#3	140	0.0100	0.0000002	11	0.0000019	39.3	99.999995
					Average EtO	Control Efficiency:	99.999996
					Required EtO	Control Efficiency:	99

Notes: (1) - PPM = parts per million by volume

(2) - DSCFM = dry standard cubic feet per minute

(3) - LBS/MIN = EtO emissions, pounds per minute

(4) - Testing was performed with the scrubber liquor level at 181 inches.

APPENDICES



APPENDIX A

Calibration Data



 Peak
 Name
 Start
 End
 Calibration
 Int.Std
 Units

 1
 Dead Vol / Air
 0.000
 0.350
 0.000

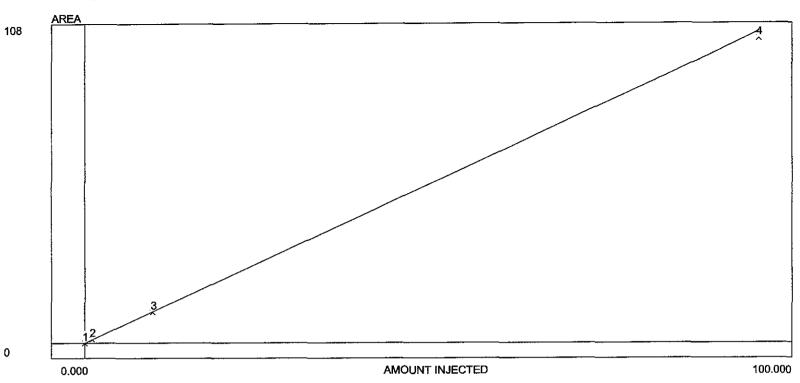
 2
 Ambient H2O
 0.350
 0.500
 0.000

 3
 Ethylene Oxide 0.500
 0.600
 C:\peak359\2Ster:0.000316ppm

 4
 Acetaldehyde
 0.600
 0.800
 0.000

 5
 CO2
 0.800
 1.000
 0.000

Calibration file: C:\peak359\2SterSLC2016.cal



Avg slope of curve: 1.10 Y-axis intercept: -0.00 Linearity: 1.00 Number of levels: 4 SD/rel SD of CF's: 0.6/66.8

Y=1.1049X r2: 1.0000

Last calibrated: Tue Apr 19 07:19:24 2016

Lv	l. Area/ht.	Amount	CF	Current	Previou	s #1Previous #2
1	0.000	0.000	0.000	0.000	N/A	N/A
2	1.260	1.100	1.145	1,260	N/A	N/A
3	11.000	10.100	1.089	11.000	N/A	N/A
4	108.000	100.000	1.080	108.000	N/A	N/A

Lab hame. ECS Client: Sterigenics - SLC Client ID: PreCal Analysis date: 04/18/2016 16:35:04 Method: Direct Injection Description: CHANNEL 2 - PID

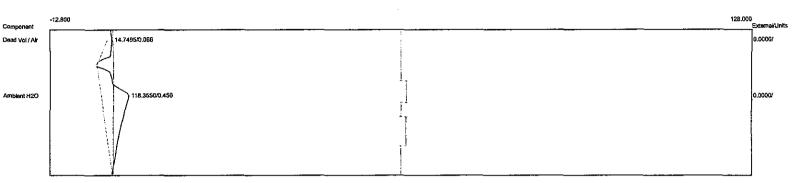
Column: 1% SP-1000, Carbopack B Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-Amb.CHR (c:\peak359)

Sample: Ambient Background

Operator: D. Kremer



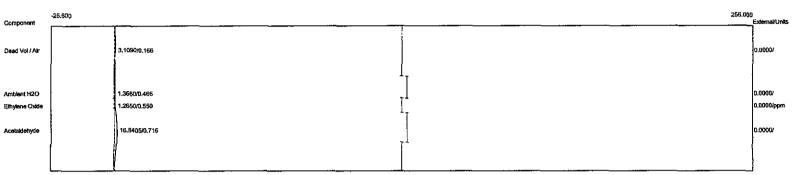
Component	Retention	Area	Externat	Units
Dead Vol / Air Ambient H2O	0.066 0.450	14.7495 118.3550	0.0000	
Ambient nzo	0,450	110.0000	0.0000	
		133.1045	0.0000	

Lab name: ECSI Client: Sterigenics - SLC Client ID: PreCal Analysis date: 04/19/2016 06:53:06 Method: Direct Injection
Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterSLC2016-C01.CHR (c:\peak359)
Sample: 1.10 ppm EtO std

Operator: D. Kremer

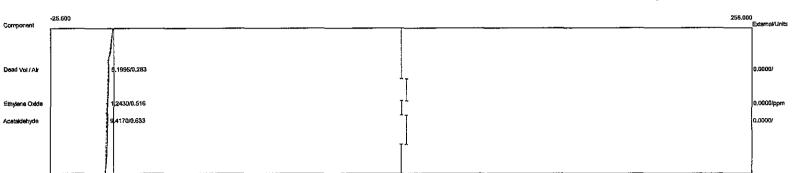


Component	Retention	Area	External	Units
Dead Vol / Air Ambient H2O Ethylene Oxide Acetaldehyde	0.166 0.466 0.550 0.716	3.1090 1.3660 1.2650 16.8405	0.0000 0.0000 0.0000 0.0000	ppm
		22.5805	0.0000	

Lab name: EUSI Client: Sterigenics - SLC Client ID: PreCal Analysis date: 04/19/2016 06:55:50 Method: Direct Injection
Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-C02.CHR (c:\peak359)
Sample: 1.10 ppm EtO std
Operator: D. Kremer



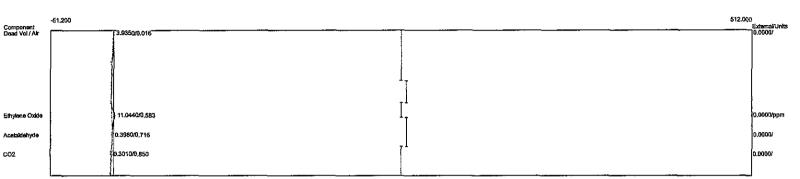
Component	Retention	Area	External	Units
Dead Vol / Air	0.283	5.1995	0.0000	
Ethylene Oxide	0.516	1.2430	0.0000	ppm
Acetaldehyde	0.633	9.4170	0.0000	
		15.8595	0.0000	

Lab name: EUSI Client: Sterigenics - SLC Client ID: PreCal Analysis date: 04/19/2016 07:00:06 Method: Direct Injection
Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-C03.CHR (c:\peak359)
Sample: 10.1 ppm EtO std

Operator: D. Kremer



Component	Retention	Area	External U	Jnits
Dead Vol / Air	0.016	3.9350	0.0000	
Ethylene Oxide	0.583	11.0440	0.0000 p	pm
Acetaldehyde	0.716	0.3980	0.0000	
CO2	0.850	0.3010	0.0000	
		15 6780	0.0000	

Client: Sterigenics - SLC Client ID: PreCal Analysis date: 04/19/2016 07:01:53

Lab hame. Econ

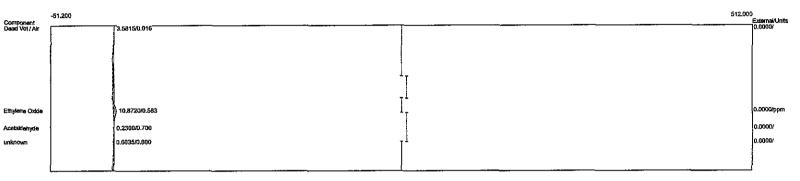
Method: Direct Injection
Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-C04.CHR (c:\peak359)

Sample: 10.1 ppm EtO std Operator: D. Kremer



Component	Retention	Area	External	Units	
Dead Vol / Air	0.016	3,5815	0.0000		
Ethylene Oxide	0.583	10.8720	0.0000 p	pm	
Acetaldehyde	0.700	0.2300	0.0000		
		14.6835	0.0000		

Client: Sterigenics - SLC Client ID: PreCal Analysis date: 04/19/2016 07:12:29

Method: Direct Injection

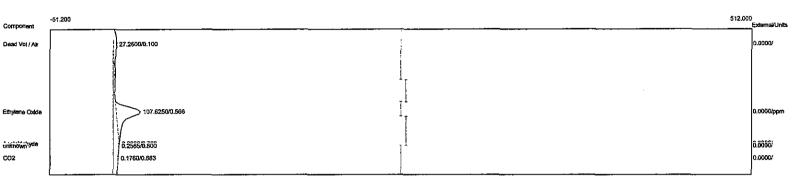
Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-C05.CHR (c:\peak359)
Sample: 100 ppm EtO std
Operator: D. Kremer



Component	Retention	Area	External Units	;
Dead Vol / Air	0,100	27.2600	0.0000	
Ethylene Oxide	0.566	107.6250	0.0000 ppm	
Acetaldehyde	0.783	0.0980	0.0000	
CO2	0.883	0.1760	0.0000	
		135,1590	0.0000	

Lab name: ECSi Client: Sterigenics - SLC Client ID: PreCal

Analysis date: 04/19/2016 07:15:03

Method: Direct Injection

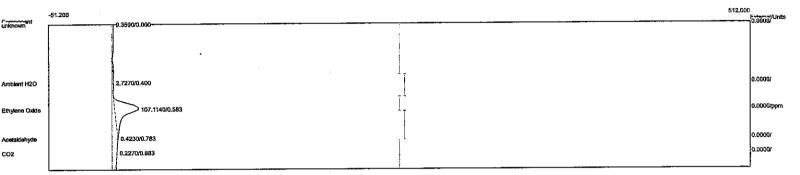
Description: CHANNEL 2 - PID

Cotumn: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-C06.CHR (c:\peak359)

Sample: 100 ppm EtO std Operator: D. Kremer



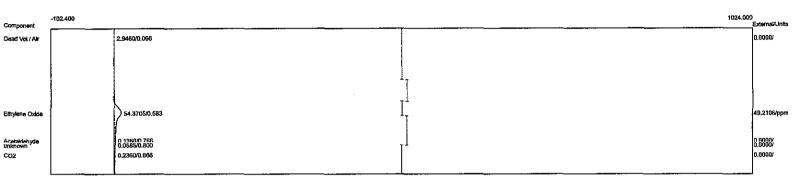
Component	Retention	Area	External	Units
Ambient H2O	0.400	2.7270	0,0000	
Ethylene Oxide	0.583	107.1140	0.0000	ppm
Acetaldehyde	0.783	0.4230	0.0000	
CO2	0.883	0.2270	0.0000	
		110,4910	0.0000	

Lab name: ECSI Client: Sterigenics - SLC Client ID: PreCal Analysis date: 04/19/2016 07:18:43 Method: Direct Injection
Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-C07.CHR (c:\peak359)
Sample: 48.8 ppm EtO std
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.066	2.9460	0.0000	
Ethylene Oxide	0.583	54.3705	49.2106	ppm
Acetaldehyde	0.766	0.1360	0.0000	
CO2	0.866	0.2360	0.0000	

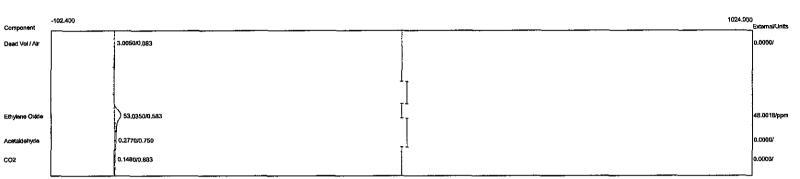
57.6885 49.2106

Lab name: EUSI Client: Sterigenics - SLC Client ID: PostCal Analysis date: 04/19/2016 12:21:01 Method: Direct Injection Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-C08.CHR (c:\peak359)
Sample: 48.8 ppm EtO std

Operator: D. Kremer



Component	Retention	Area	External Units	
Dead Vol / Air	0.083	3.0050	0.0000	
Ethylene Oxide	0.583	53.0350	48.0018 ppm	
Acetaldehyde	0.750	0.2770	0.0000	
CO2	0.883	0.1480	0.0000	

56.4650 48.0018

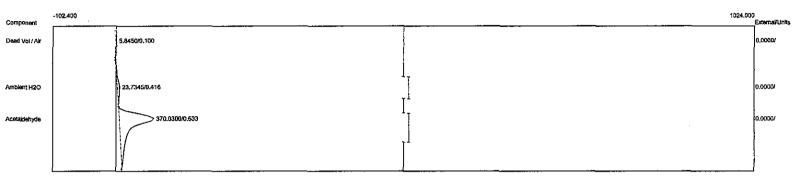
APPENDIX B

Run#1 Chromatograms



Client: Sterigenics - SLC Client ID: Run#1Exh Analysis date: 04/19/2016 10:04:08
Method: Direct Injection
Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B Carrier: HELIUM

Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterSLC2016-1E01.CHR (c:\peak359)
Sample: Scrubber Outlet
Operator: D. Kremer



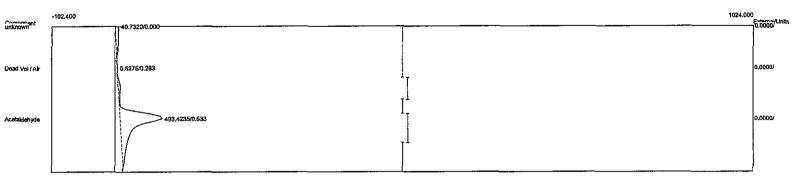
Component	Retention	Area	External	Units
Dead Vol / Air	0.100	5.8450	0.0000	
Ambient H2O	0.416	23.7345	0.0000	
Acetaldehyde	0.633	370.0300	0.0000	
		399.6095	0.0000	

Lab name: EUSI Client: Sterigenics - SLC Client ID: Run#1Exh
Analysis date: 04/19/2016 10:05:31
Method: Direct Injection
Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-1E02.CHR (c:\peak359)
Sample: Scrubber Outlet
Operator: D. Kremer



External Units Component Retention Area 0.0000 Dead Vol / Air 0.283 0.6275 0.0000 Acetaldehyde 0.633 493.4235 494.0510 0.0000

Lab name: ECSi Client: Sterigenics - SLC Client ID: Run#1Exh Analysis date: 04/19/2016 10:06:55

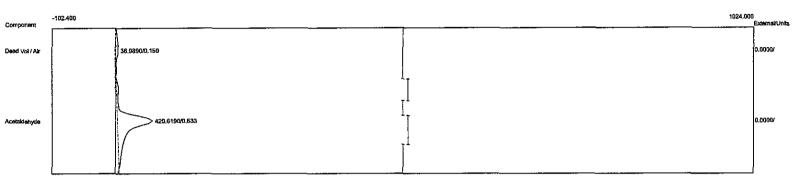
Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-1E03.CHR (c:\peak359)
Sample: Scrubber Outlet
Operator: D. Kremer



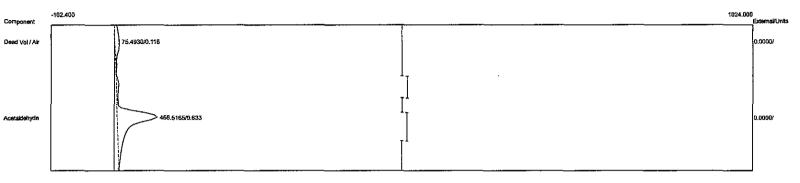
External Units Component Retention Area 36.9890 0.0000 Dead Vol / Air 0.150 Acetaldehyde 0.633 420.6190 0.0000 457.6080 0.0000

Lab name: EUSI Client: Sterigenics - SLC Client ID: Run#1Exh Analysis date: 04/19/2016 10:08:19 Method: Direct Injection
Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-1E04.CHR (c:\peak359)
Sample: Scrubber Outlet

Operator: D. Kremer



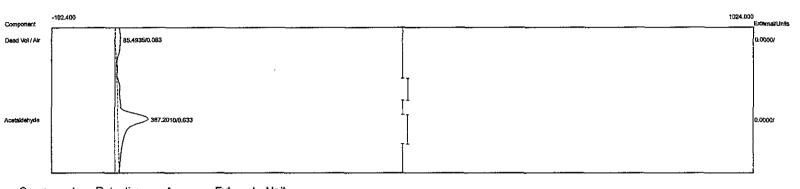
External Units Component Retention Area Dead Vol / Air 0.116 75.4930 0.0000 Acetaldehyde 0.633 466.5165 0.0000 542.0095 0.0000

Client: Sterigenics - SLC
Client ID: Run#1Exh
Analysis date: 04/19/2016 10:09:45
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Components: eto2-100.cpt
Data file: 2SterSLC2016-1E05.CHR (c:\peak359)

Sample: Scrubber Outlet Operator: D. Kremer



 Component
 Retention
 Area
 External
 Units

 Dead Vol / Air
 0.083
 85.4935
 0.0000

 Acetaidehyde
 0.633
 387.2010
 0.0000

 472.6945
 0.0000

Lab hame: ECSI Client: Sterigenics - SLC Client ID: Run#1Exh Analysis date: 04/19/2016 10:11:00 Method: Direct Injection

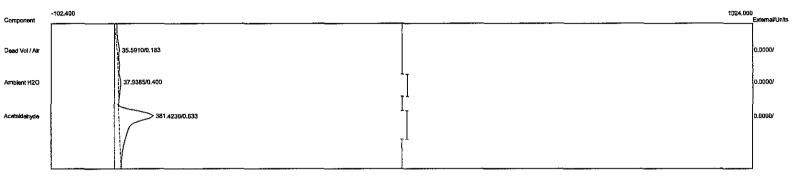
Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-1E06.CHR (c:\peak359)
Sample: Scrubber Outlet
Operator: D. Kremer



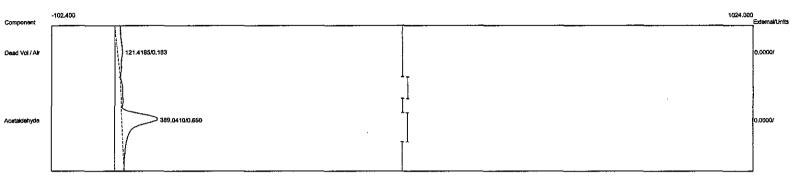
Component	Retention	Area	External	Units
Dead Vol / Air	0.183	35.5910	0.0000	
Ambient H2O	0.400	37.9385	0.0000	
Acetaldehyde	0.633	381.4230	0.0000	
		454.9525	0.0000	

Lab Hairie. ECOI Client: Sterigenics - SLC Client ID: Run#1Exh Analysis date: 04/19/2016 10:12:29 Method: Direct Injection
Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-1E07.CHR (c:\peak359)
Sample: Scrubber Outlet

Operator: D. Kremer



External Units Component Retention Агеа Dead Vol / Air 0.183 121.4185 0.0000 0.0000 Acetaldehyde 0.650 389.0410 0.0000 510.4595

APPENDIX C

Run#2 Chromatograms

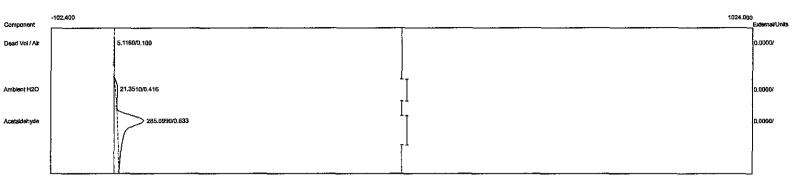


Client: Sterigenics - SLC Client ID: Run#2Exh Analysis date: 04/19/2016 10:43:11 Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B

Carrier: HELIUM
Temp. prog: eto-100.tem
Components: eto2-100.cpt

Data file: 2SterSLC2016-2E01.CHR (c:\peak359)
Sample: Scrubber Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.100	5.1160	0.0000	
Ambient H2O	0.416	21.3510	0.0000	
Acetaldehyde	0.633	285.0990	0.0000	
		311.5660	0.0000	

Lab name: EGSI Client: Sterigenics - SLC Client ID: Run#2Exh Analysis date: 04/19/2016 10:44:21 Method: Direct Injection

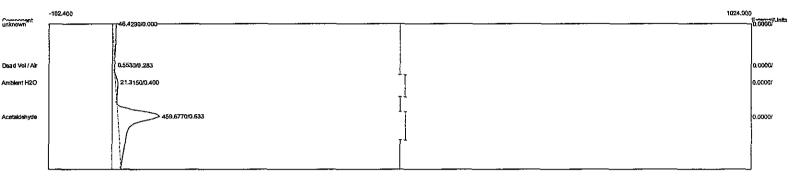
Description: CHANNEL 2 - PID

Cotumn: 1% SP-1000, Carbopack B

Carrier: HELIUM

Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterSLC2016-2E02.CHR (c:\peak359)

Sample: Scrubber Outlet Operator: D. Kremer



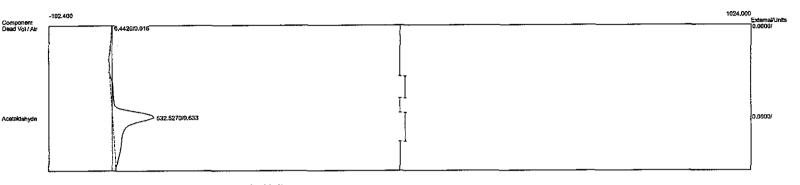
Component	Retention	Area	External	Units
Dead Vol / Air	0.283	0.5530	0.0000	
Ambient H2O	0.400	21.3150	0.0000	
Acetaldehyde	0.633	459.6770	0.0000	
		481.5450	0.0000	

Lab name: EUSI Client: Sterigenics - SLC Client ID: Run#2Exh Analysis date: 04/19/2016 10:45:31 Method: Direct Injection
Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-2E03.CHR (c:\peak359)
Sample: Scrubber Outlet

Operator: D. Kremer



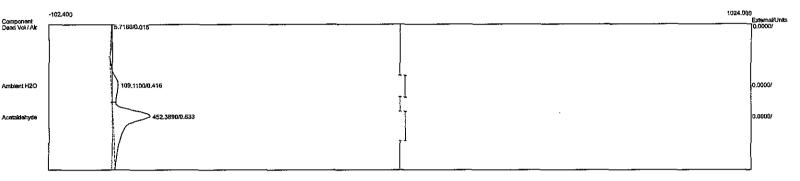
Retention Area External Units Component 0.0000 Dead Vol / Air 0.016 6.4420 0.0000 Acetaldehyde 0.633 532.5270 538.9690 0.0000

Lab name: ECSI Client: Sterigenics - SLC Client ID: Run#2Exh Analysis date: 04/19/2016 10:46:52
Method: Direct Injection
Description: CHANNEL 2 - PID Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-2E04.CHR (c:\peak359)
Sample: Scrubber Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.016	5.7160	0.0000	
Ambient H2O	0.416	109.1100	0.0000	
Acetaldehyde	0.633	452.3890	0.0000	
		567.2150	0.0000	

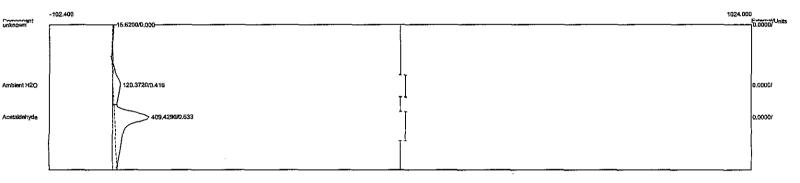
Client: Sterigenics - SLC
Client ID: Run#2Exh
Analysis date: 04/19/2016 10:48:02
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SR-1000 Cerboner

Column: 1% SP-1000, Carbopack B Carrier: HELIUM

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Components: eto2-100.cpt
Data file: 2SterSLC2016-2E05.CHR (c:\peak359)

Sample: Scrubber Outlet
Operator: D. Kremer



 Component
 Retention
 Area
 External
 Units

 Ambient H2O
 0.416
 120.3720
 0.0000

 Acetaldehyde
 0.633
 409.4290
 0.0000

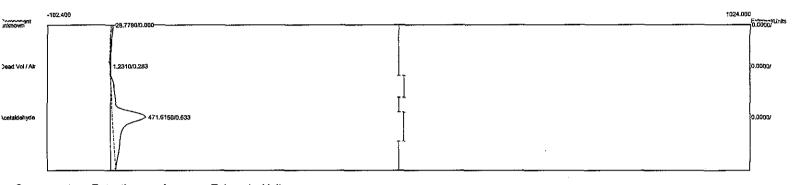
 529.8010
 0.0000

Client: Sterigenics - SLC
Client ID: Run#2Exh
Analysis date: 04/19/2016 10:49:12
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-2E06.CHR (c:\peak359)

Sample: Scrubber Outlet Operator: D. Kremer



 Component
 Retention
 Area
 External
 Units

 Dead Vol / Air
 0.283
 1.2310
 0.0000

 Acetaldehyde
 0.633
 471.6150
 0.0000

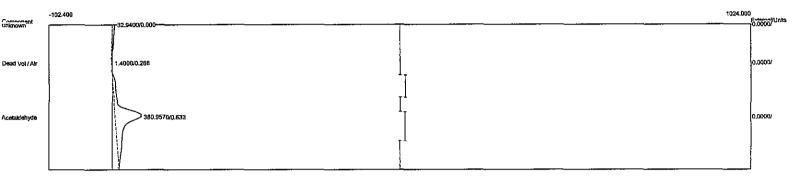
 472.8460
 0.0000

Lab name: ECSi Client: Sterigenics - SLC Client ID: Run#2Exh Analysis date: 04/19/2016 10:50:21 Method: Direct Injection Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B

Carrier: HELIUM

Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterSLC2016-2E07.CHR (c:\peak359)

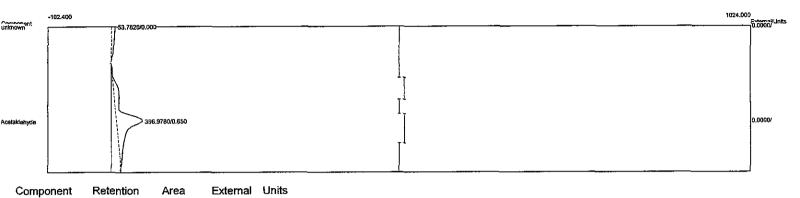
Sample: Scrubber Outlet Operator: D. Kremer



Retention External Units Component Агеа 0.266 1.4000 0.0000 Dead Vol / Air Acetaldehyde 0.633 380.9570 0.0000 382.3570 0.0000

Lab name: EUSI Client: Sterigenics - SLC Client ID: Run#2Exh Analysis date: 04/19/2016 10:51:38 Method: Direct Injection Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B Carrier: HELIUM Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterSLC2016-2E08.CHR (c:\peak359)
Sample: Scrubber Outlet

Operator: D. Kremer



Acetaldehyde

0.650

396.9780

0.0000

396.9780

0.0000

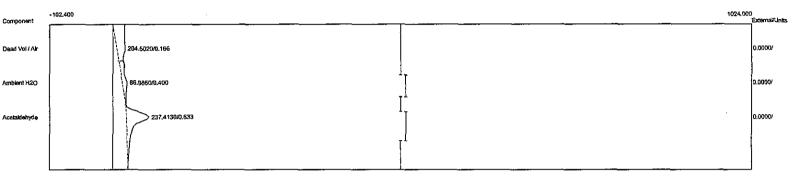
Lab name: ECSI Client: Sterigenics - SLC Client ID: Run#2Exh Analysis date: 04/19/2016 10:53:26 Method: Direct Injection

Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-2E09.CHR (c:\peak359)
Sample: Scrubber Outlet
Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.166	204.5020	0.0000	
Ambient H2O	0.400	86.9860	0.0000	
Acetaldehyde	0.633	237.4130	0.0000	
		528.9010	0.0000	

APPENDIX D

Run#3 Chromatograms

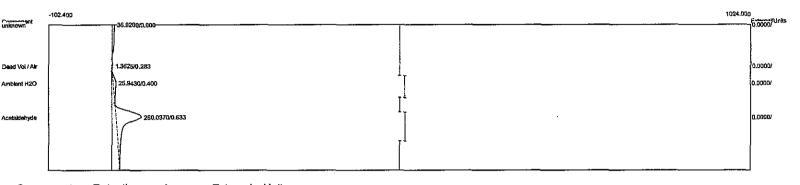


Lab Haille. LCSI Client: Sterigenics - SLC Client ID: Run#3Exh Analysis date: 04/19/2016 10:59:12 Method: Direct Injection Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-3E01.CHR (c:\peak359)

Sample: Scrubber Outlet Operator: D. Kremer



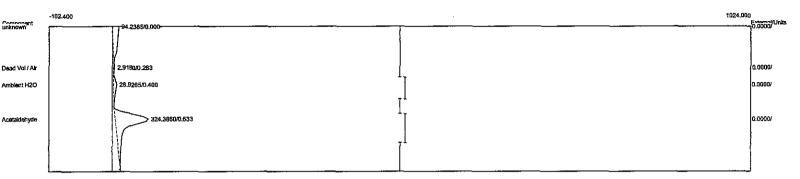
Retention External Units Component Area Dead Vol / Air 0.283 1.3625 0.0000 0.0000 Ambient H2O 0.400 25.9430 Acetaldehyde 0.633 260.0370 0.0000 287.3425 0.0000

Lab name: ECSI Client: Sterigenics - SLC Client ID: Run#3Exh Analysis date: 04/19/2016 11:00:22 Method: Direct Injection
Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM
Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-3E02.CHR (c:\peak359)
Sample: Scrubber Outlet
Operator: D. Kremer

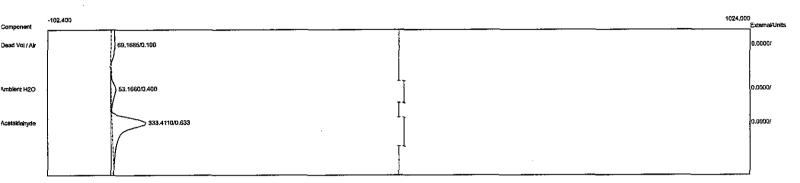


Component	Retention	Area	External	Units
Dead Vol / Air	0.283	2.9180	0.0000	
Ambient H2O	0.400	28.9265	0.0000	
Acetaldehyde	0.633	324.3860	0.0000	
		356.2305	0.0000	

Lab name: EUSI Client: Sterigenics - SLC Client ID: Run#3Exh Analysis date: 04/19/2016 11:01:58 Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM

Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-3E03.CHR (c:\peak359)
Sample: Scrubber Outlet
Operator: D. Kremer

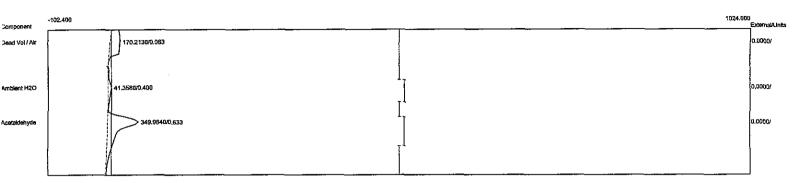


Component	Retention	Area	External	Units
Dead Vol / Air	0.100	69.1685	0.0000	
Ambient H2O	0.400	53.1660	0.0000	
Acetaldehyde	0.633	333.4110	0.0000	
		455.7455	0.0000	

Client: Sterigenics - SLC Client ID: Run#3Exh Analysis date: 04/19/2016 11:03:13 Method: Direct Injection Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B
Carrier: HELIUM

Temp. prog: eto-100.tem
Components: eto2-100.cpt
Data file: 2SterSLC2016-3E04.CHR (c:\peak359)
Sample: Scrubber Outlet

Operator: D. Kremer



Component	Retention	Area	External	Units
Dead Vol / Air	0.083	170.2130	0.0000	
Ambient H2O	0.400	41.3580	0.0000	
Acetaldehyde	0.633	349.9840	0.0000	
		561.5550	0.0000	

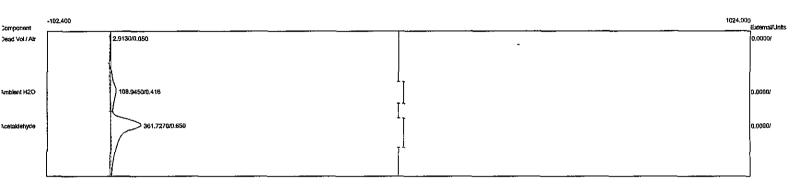
Client: Sterigenics - SLC
Client ID: Run#3Exh
Analysis date: 04/19/2016 11:04:33
Method: Direct Injection
Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-3E05.CHR (c:\peak359)

Sample: Scrubber Outlet Operator: D. Kremer



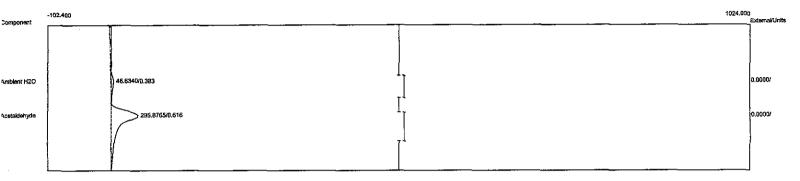
Component	Retention	Area	External	Units
Dead Vol / Air	0.050	2.9130	0.0000	
Ambient H2O	0.416	108.9450	0.0000	
Acetaldehyde	0.650	361.7270	0.0000	
		473.5850	0.0000	

Client: Sterigenics - SLC
Client ID: Run#3Exh
Analysis date: 04/19/2016 11:05:54
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-3E06.CHR (c:\peak359)

Sample: Scrubber Outlet Operator: D. Kremer



 Component
 Retention
 Area
 External
 Units

 Ambient H2O
 0.383
 46.6340
 0.0000

 Acetaldehyde
 0.616
 295.8765
 0.0000

 342.5105
 0.0000

Lab name: ECSi Client: Sterigenics - SLC Client ID: Run#3Exh Analysis date: 04/19/2016 11:07:01

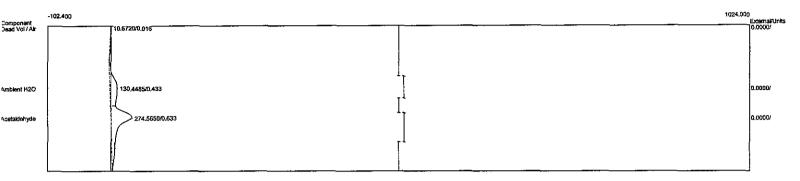
Method: Direct Injection
Description: CHANNEL 2 - PID

Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem

Components: eto2-100.cpt
Data file: 2SterSLC2016-3E07.CHR (c:\peak359)

Sample: Scrubber Outlet Operator: D. Kremer



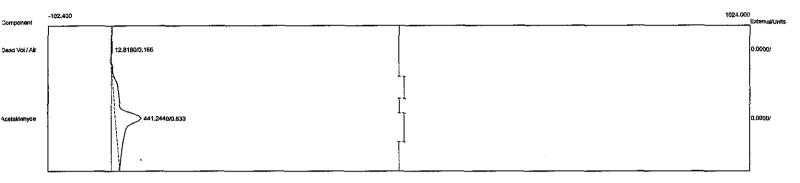
Component	Retention	Area	External	Units
Dead Vol / Air	0.016	10.6720	0.0000	
Ambient H2O	0.433	130.4485	0.0000	
Acetaldehyde	0.633	274.5650	0.0000	
		415.6855	0.0000	

Client: Sterigenics - SLC
Client ID: Run#3Exh
Analysis date: 04/19/2016 11:08:17
Method: Direct Injection
Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B

Carrier: HELIUM Temp. prog: eto-100.tem Components: eto2-100.cpt

Data file: 2SterSLC2016-3E08.CHR (c:\peak359)

Sample: Scrubber Outlet Operator: D. Kremer

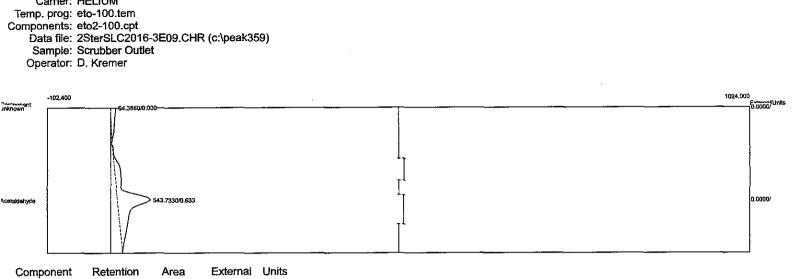


 Component
 Retention
 Area
 External
 Units

 Dead Vol / Air
 0.166
 12.8180
 0.0000

 Acetaldehyde
 0.633
 441.2440
 0.0000

 454.0620
 0.0000



Lab name: ECSi

Carrier: HELIUM

Client: Sterigenics - SLC Client ID: Run#3Exh Analysis date: 04/19/2016 11:09:29 Method: Direct Injection

Description: CHANNEL 2 - PID
Column: 1% SP-1000, Carbopack B

0.633

Acetaldehyde

543.7330

543.7330

0.0000

0.0000

APPENDIX E

Field Data and Calculation Worksheets



ECSi, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #1 (Ceilcote Scrubber Outlet) - Chamber #4 Sterigenics, Inc. - Salt Lake City, UT **April 19, 2016**

				1-%H2O =	0.972	
<u>DeltaP</u>	SqRtDeltaP	Temp (F)	ppm EtO	mw =	28.54	
				stack area =	0.785	
0.0025	0.0500	68	0.01	press =	25.80	
0.0025	0.0500	68	0.01	Tstd =	528	
0.0025	0.0500	68	0.01	Pstd =	29.92	
0.0025	0.0500	69	0.01	Cp =	0.99	
0.0025	0.0500	69	0.01	Kp =	85.49	
0.0025	0.0500	69	0.01			
0.0025	0.0500	70	0.01	Velocity =	3.6	ft/sec
				Flow =	141	dscfm
Average =						
0.0025	0.0500	68.7	0.0100	MWeto =	44.05	
				MolVol =	385.32	
	=	529	degR	ppmv/ft3 =	1000000	
				EtO Mass Flow =	0.0000002	lbs/min
				evac start =	1003	
				evac stop =	1012	
				min/cycle =	9	
				EtO Emissions =	0.0000015	lbs/cycle
						-
INLET CALC	ULATION:					
Dro Evos	· \/ _	1000	f+2	Doot Evee: \/ -	1000	f+2

Pre-Evac:	V =	1088	ft3	Post-Evac:	V =	1088	ft3
	P =	14.4	in Hg Abs		P =	3.0	in Hg Abs
	T =	125	degF		T =	124	degF
	R =	10.73			R =	10.73	
	mw =	44.05			mw =	44.05	
lbs EtO @	0 100% =	53.90	lbs	lbs EtO @	100% =	11.25	lbs

Initial EtO = Scale Wt. = 51.9 lbs % EtO @ Chamber = Scale Wt. / lbs EtO @ 100% (Pre) = 96.3 % Final EtO = % EtO @ Chamber X lbs EtO @ 100% (Post) = 10.8 lbs INLET ETO = Initial EtO - Final EtO = 41.1 lbs

CONTROL EFFICIENCY = 99.999996 %

ECSi, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #2 (Ceilcote Scrubber Outlet) - Chamber #2 Sterigenics, Inc. - Salt Lake City, UT April 19, 2016

<u>DeltaP</u>	<u>SqRtDeltaP</u>	Temp (F)	ppm EtO	1-%H2O = mw = stack area =	0.972 28.54 0.785	
0.0025	0.0500	75	0.01	press =	25.80	
0.0025	0.0500	75	0.01	Tstd =	528	
0.0025	0.0500	75	0.01	Pstd =	29.92	
0.0025	0.0500	75	0.01	Cp =	0.99	
0.0025	0.0500	75	0.01	Kp =	85.49	
0.0025	0.0500	75	0.01			
0.0025	0.0500	75	0.01	Velocity =	3.6	ft/sec
0.0025	0.0500	76	0.01	Flow =	140	dscfm
0.0025	0.0500	76	0.01			
				MWeto =	44.05	
Average =				MolVol =	385.32	
0.0025	0.0500	75.2	0.0100	ppmv/ft3 =	1000000	
	=	535	degR	EtO Mass Flow =	0.0000002	lbs/min
				evac start =	1042	
				evac stop =	1053	
				min/cycle =	11	
				EtO Emissions =	0.0000018	lbs/cycle

INLET CALCULATION:

Pre-Evac:	V =	1088	ft3	Post-Evac:	V =	1088	ft3
	P =	14.4	in Hg Abs		P =	3.0	in Hg Abs
	T =	126	degF		T =	124	degF
	R =	10.73			R =	10.73	
	mw =	44.05			mw =	44.05	
lbs EtO @	100% =	53.80	lbs	lbs EtO @	100% =	11.25	lbs

Initial EtO = Scale Wt. =	50.4	lbs
% EtO @ Chamber = Scale Wt. / lbs EtO @ 100% (Pre) =	93.7	%
Final EtO = % EtO @ Chamber X lbs EtO @ 100% (Post) =	10.5	lbs
INLET ETO = Initial EtO - Final EtO =	39.9	lbs

CONTROL EFFICIENCY = 99.999996 %

ECSi, Inc.

Ethylene Oxide Mass Emissions Data and Calculations

Run #3 (Ceilcote Scrubber Outlet) - Chamber #6 Sterigenics, Inc. - Salt Lake City, UT **April 19, 2016**

				1-%H2O =	0.972	
<u>DeltaP</u>	SqRtDeltaP	Temp (F)	ppm EtO	mw =	28.54	
				stack area =	0.785	
0.0025	0.0500	76	0.01	press =	25.80	
0.0025	0.0500	75	0.01	Tstd =	528	
0.0025	0.0500	75	0.01	Pstd =	29.92	
0.0025	0.0500	75	0.01	Cp =	0.99	
0.0025	0.0500	76	0.01	Kp =	85.49	
0.0025	0.0500	76	0.01			
0.0025	0.0500	76	0.01	Velocity =	3.6	ft/sec
0.0025	0.0500	77	0.01	Flow =	140	dscfm
0.0025	0.0500	78	0.01			
				MWeto =	44.05	
Average =				MolVol =	385.32	
0.0025	0.0500	76.0	0.0100	ppmv/ft3 =	1000000	
	=	536	degR	EtO Mass Flow =	0.0000002	lbs/min
				evac start =	1058	
				evac stop =	1110	
				min/cycle =	12	
				EtO Emissions =	0.0000019	lbs/cycle

issions = 0.0000019 lbs/cycle

INLET CALCULATION:

Pre-Evac:	V =	1088	ft3	Post-Evac:	V =	1088	ft3
	P =	14.5	in Hg Abs		P =	3.0	in Hg Abs
	T =	125	degF		T =	124	degF
	R =	10.73			R =	10.73	
	mw =	44.05			mw =	44.05	
lbs EtO @	100% =	54.27	lbs	lbs EtO @	100% =	11.25	lbs

Initial EtO = Scale Wt. = 49.6 lbs % EtO @ Chamber = Scale Wt. / lbs EtO @ 100% (Pre) = 91.4 % Final EtO = % EtO @ Chamber X lbs EtO @ 100% (Post) = 10.3 lbs INLET ETO = Initial EtO - Final EtO = 39.3 lbs

CONTROL EFFICIENCY = 99.999995 %

ECSi - VELOCITY TRAVERSE DATA

Client:	Sterigenics, Inc.	Run #:	1	Date:	4/19/2016	Port Sketch
Location: _	Salt Lake City, Utah	Probe Type:	Std.	Baro Press:	25.80	_
Source:	Ceilcote Packed Tower Scrubber Outlet	Stack I.D.:	12 in.	Static Press:	-0.01	

	Port 1							Port 2					
Inches			Del	ta P		Stack	Cyclonic			Del	ta P		Stack
From Port	Point#	Low	High	Average	Sq Root	Temp (F)	Angle	Point#	Low	High	Average	Sq Root	Temp (F)
0.4	1	0.0025	0.0025	0.0025	0.0500	67	0	1	0.0025	0.0025	0.0025	0.0500	67
1.25	2	0.0025	0.0025	0.0025	0.0500	67	0	2	0.0025	0.0025	0.0025	0.0500	67
2.3	3	0.0025	0.0025	0.0025	0.0500	68	0	3	0.0025	0.0025	0.0025	0.0500	67
3.9	4	0.0025	0.0025	0.0025	0.0500	68	0	4	0.0025	0.0025	0.0025	0.0500	67
8.1	5	0.0025	0.0025	0.0025	0.0500	68	0	5	0.0025	0.0025	0.0025	0.0500	68
9.7	6	0.0025	0.0025	0.0025	0.0500	68	0	6	0.0025	0.0025	0.0025	0.0500	68
10.75	7	0.0025	0.0025	0.0025	0.0500	68	0	7	0.0025	0.0025	0.0025	0.0500	68
11.6	8	0.0025	0.0025	0.0025	0.0500	68	0	8	0.0025	0.0025	0.0025	0.0500	68
	9							9					
	10							10					
	11							11					
	12							12					
	13							13					
	14							14					
	15							15					
	16							16					
	17							17					
	18							18					
	19							19					
	20							20					
	21							21					
	22							22					
	23							23					
	24							24					
									Avera	ge Values:	0.0025	0.0500	67.6

Cyclonic Angle

0.0

ECSi Stack Moisture Calculations Sterigenics, Inc. - Salt Lake City, UT April 18, 2016

Ceilcote Scrubber Outlet

	Wet Bulb (degF) 53		Dry Bulb(degF) 65		
lbs H2O/lb dry air (per chart) =	0.0167				
Volume Fraction @ dry air =	<u>lbs H2O</u> lb dry air	Х	28.95 lbs air mole air	X	1 mole H2O 18 lbs H2O
=	0.0167	Χ	28.95	Χ	0.05556
=	0.0269				
Volume Fraction @ wet air =	Volume Fraction 1 - Volume Fration		·)		
=	2.76	%			

ETHYLENE OXIDE SOURCE TEST/CALIBRATION DATA

Client: Steriolinics Steriolinics Source Tested: Colicote Pacced Owes Scrubbes Date: 4 9 16	Source Tested:C	1.1											
Calibration Gas		alcote Y	acked) Tou	res S	crubt	set 1	Date: 4/	9/16				
Calibration Gas							and the second s						
Conc. (ppmv) ppm EtO ppm ppm ppm ppm ppm EtO ppm EtO			PRI	E CALI	BRATI	ON							
(FID) Area Counts #2 Average Area Audit Standard (48.8 ppmv) Result Calibration Gas Conc. (ppmv) Dutlet Area Counts #1 (PID) Area Counts #1 Average Area Audit Standard (48.8 ppmv) Result (PID) Area Counts #2 Average Area Audit Standard (48.8 ppmv) Result Ch. 4 Ch. 7 Ch. 6 Run #1 Run #2 Run #3 Fig. 1003 Pbar: 35.80 Eto Usage (lbs/yr):	<u>.</u>	·	ppm	ppm	ppm	ppm							
Average Area Audit Standard (48.8 ppmv) Result Calibration Gas Conc. (ppmv)	Inlet Area Cou	ints #1											
Audit Standard (48.8 ppmv) Result Calibration Gas Conc. (ppmv)	(FID) Area Cou	ints #2											
Calibration Gas Conc. (ppmv) Dutlet Area Counts #1 (PID) Area Counts #2 Average Area Audit Standard (48.8 ppmv) Result Ch.4 Ch.7 Ch.7 Run #1 Run #2 Run #3 Fbar: 35.80 EtO Usage (lbs/yr):	Average	Area _					***************************************						
Outlet Area Counts #1 1.27 11.0 108 (PID) Area Counts #2 1.24 10.4 10.7 Average Area 1.26 11.0 108 Audit Standard (48.8 ppmv) Result 14.2 V Ch.4 Ch.2 Ch.6 Run #1 Run #2 Run #3 Exh. Start: 1003 1042 1058 Pbar: 25.80 Eto Usage (lbs/yr):		Aud	it Standard	(48.8 ppm	v) Result								
(PID) Area Counts #2 1.24 10.4 10.7 Average Area 1.26 11.0 108 Audit Standard (48.8 ppmv) Result 149.2 V Ch.4 Ch.2 Ch.6 Run #1 Run #2 Run #3 Exh Stat: 1003 1042 1058 Pbar: 35.80 Et0 Usage (lbs/yr):	1		ppm	ppm									
Average Area 1.26 11.0 108 Audit Standard (48.8 ppmv) Result 1/9.2 V Ch.4 Ch.2 Ch.6 Run #1 Run #2 Run #3 Ext. Start: 1003 1042 1058 Pbar: 35.80 Eto Usage (lbs/yr):	Outlet Area Cou	ints #1 (.27	11.0	108									
Audit Standard (48.8 ppmv) Result UQ.2 V Ch.4 Ch.2 Ch.6 Run #1 Run #2 Run #3 Ext. Start: 1003 1042 1058 Pbar: 35.80 EtO Usage (lbs/yr):	(PID) Area Cou	ints #2 1.24	10.d	107									
Ch. 4 Ch. 2 Ch. 6 Run #1 Run #2 Run #3 Ext. Start: 1003 1042 1058 Pbar: 35.80 EtO Usage (lbs/yr):	Average	Area 1,26	11.0	108			<u> </u>						
Ch. 4 Ch. 2 Ch. 6 Run #1 Run #2 Run #3 Ext. Stat: 1003 1042 1058 Pbar: 35.80 EtO Usage (lbs/yr):		Aud	it Standard	(48.8 ppm	v) Result	49.2	$\checkmark)$						
Run #1 Run #2 Run #3 EA Stat: 1003 1042 1058 Pbar: 35.80 Et0 Usage (lbs/yr):	Ch	.4 Ch.Z	Ch.6				/						
Exh Stop: 1012 1053 1110 %H2O: 3 Cycles Per Week:	1 1			P_{bar}	: 39	7.80	EtO Usag	ge (lbs/yr):					
	Fish Stop: 10	12 1053	1110	%H	₂ O:	3	Cycles Pe	er Week:					
POST CALIBRATION			POS	T CAL	IBRAT	ION							
Calibration Gas Conc. (ppmv) Calibration Gas Conc. (ppmv) Conc. (ppmv)	1	1	ppm	ppm	ppm	ppm							
Inlet Area Counts #1		nts #1			and the state of t								
(FID) Area Counts #2	Inlet Area Cour	nts #2											
Average Area													
Audit Standard (48.8 ppmv) Result	(FID) Area Cour	Area			Audit Standard (48.8 ppmv) Result								
Calibration Gas 1.10 ppm EtO ppm EtO ppm EtO EtO EtO	(FID) Area Cour		it Standard	(48.8 ppm	v) Result								
Outlet Area Counts #1	(FID) Area Cour Average	Aud	10.1 ppm	100 ppm	v) Result								
(PID) Area Counts #2	(FID) Area Cour Average Calibration Conc. (pp	Aud n Gas 1.10 ppm EtO	10.1 ppm	100 ppm	v) Result								
Average Area	(FID) Area Cour Average Calibration Conc. (pp	Aud n Gas 1.10 ppm EtO nts #1	10.1 ppm	100 ppm	v) Result								
Audit Standard (48.8 ppmv) Result 42.0	(FID) Area Cour Average Calibration Conc. (pp Outlet Area Cour (PID) Area Cour	Aud n Gas 1.10 ppmv) ppm EtO nts #1 nts #2	10.1 ppm	100 ppm	v) Result								

APPENDIX F

Gas Certifications



CERTIFIED WORKING CLASS

Phone: 909-887-2571 Fax: 909-887-0549

Single-Certified Calibration Standard



CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-001 Item No.: 02020001310TCL P.O. No.: VBL - D. KREMER

Cylinder Number: CAL4448

Cylinder Size: CL

Certification Date: 14Apr2014

Customer

ECSI, INC PO BOX 848

SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE NITROGEN

Concentration (Moles)

1.10 PPM

BALANCE

Accuracy (+ <u>/-</u>%)

5

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:	 ~ (
	 MT	

DATE: 4-14-14

Page 1 of 2

SPECIFICATIONS	Requested Concentration (Moles)		Certified Concentration (Moles)		Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	
Component Name	(INIOR	:51	(Intoic.	21	111 101		
EIHYLENE OXIDE	1.	PPM BAL	1.10	PPM BAL	10.0	5.00	

TRACEABILITY

Traceable To Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure:

1400 PSIG

Expiration Date: 14Apr2016

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

COMMENTS

Single-Certified Calibration Standard



Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-003 Item No.: 02020001320TCL P.O. No.: VBL – D. KREMER

Cylinder Number: CLM003232 Cylinder Size: CL Certification Date: 14Apr2014 Customer

ECSI, INC PO BOX 848

SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE NITROGEN

Concentration (Moles)

10.1 PPM BALANCE Accuracy (+ /-%)

5

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:		DATE:	4-14-14
	IVI I		

SPECIFICATIONS Component Name	Reque Concent (Mole	tration	Certific Concentr (Mole	ation	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	
ETHYLENE OXIDE NITROGEN	10.	PPM BAL	10.1	PPM BAL	1.0	5.00	

Traceable To Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure:

1600 PSIG

Expiration Date: 14Apr2016

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

Single-Certified Calibration Standard



Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information Project No.: 02-57164-004 Item No.: 02020001330TCL P.O. No.: VBL - D. KREMER

Cylinder Number: CLM011385 Cylinder Size: CL Certification Date: 14Apr2014

Customer

ECSI, INC **PO BOX 848**

SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE **NITROGEN**

Concentration (Moles)

100.

PPM **BALANCE** Accuracy (+/-%)

5

TRACEABILITY

Traceable To

Scott Reference Standard

DATE: 4-14-14

1 of 2 Page

SPECIFICATIONS Component Name	Reque Concent (Mole	ration	Certif Concent (Mol	tration	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	
ETHYLENE OXIDE	100.	PPM BAL	100.	PPM BAL	.0	5.00	

Traceable To Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure:

1500 PSIG

Valve Connection: CGA 350

Expiration Date: 14Apr2016

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

Single-Certified Calibration Standard



00 CAJON BLVD., SAN BERNARDINO, CA 92411

Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-005 Item No.: 02020001340TCL P.O. No.: VBL – D. KREMER

Cylinder Number: CLM002810 Cylinder Size: CL Certification Date: 14Apr2014 <u>Customer</u>

ECSI, INC PO BOX 848

SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE NITROGEN

Concentration (Moles)

1.000.

PPM BALANCE Accuracy (+/-%)

5

TRACEABILITY

Traceable To-

Scott Reference Standard

APPROVED BY:

SBLM Ally

DATE: ____4-14-14

Page 1 of 2

SPECIFICATIONS Component Name	Reque Concent (Mol	tration	Certifi Concent (Mole	ration	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	·
ETHYLENE OXIDE	1,000.	PPM BAL	1,000.	PPM BAL	.0	5.00	

Traceable To

Scott Reference. Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 1400 PSIG

Valve Connection: CGA 350

Expiration Date: 14Apr2016

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.

Single-Certified Calibration Standard



Phone: 909-887-2571 Fax: 909-887-0549

CERTIFICATE OF ACCURACY: Certified Working Class Calibration Standard

Product Information

Project No.: 02-57164-006 Item No.: 02020001340TCL P.O. No.: VBL – D. KREMER

Cylinder Number: CLM005787

Cylinder Size: CL

Certification Date: 14Apr2014

Customer

ECSI, INC PO BOX 848

SAN CLEMENTE, CA 92672

CERTIFIED CONCENTRATION

Component Name

ETHYLENE OXIDE NITROGEN

Concentration (Moles)

10.080.

PPM BALANCE

5

Accuracy

(+/-%)

TRACEABILITY

Traceable To

Scott Reference Standard

APPROVED BY:

3 M - Cully

DATE: <u>4-14-14</u>

Page 1 of 2

SPECIFICATIONS Component Name.	Reque Concent (Mole	ration	Certifi Concent (Mole	ration	Blend Tolerance Result (+/- %)	Certified Accuracy Result (+/- %)	
ETHYLENE OXIDE	10,000.	PPM	10,080.	PPM	.8	5.00	
NITROGEN		BAL		BAL			

Traceable To Scott Reference Standard

PHYSICAL PROPERTIES

Cylinder Size: CL

Pressure: 900 PSIG Expiration Date: 14Apr2016

Valve Connection: CGA 350

SPECIAL HANDLING INSTRUCTIONS

Do not use or store cylinder at or below the stated dew point temperature. Possible condensation of heavier components could result. In the event the cylinder has been exposed to temperatures at or below the dew point, place cylinder in heated area for 24 hours and then roll cylinder for 15 minutes to re-mix.

Use of calibration standards at or below dew point temperature may result in calibration error.



CERTIFICATE OF ANALYSIS

Customer Name:

ECSi, Inc.

Stock or Analyzer Tag Number:

N/A

SA25925

Customer Reference:

Verbal- Dan 104448

Product Class: Cylinder - Contents¹:

Certified Standard 28 CF @ 2000 PSI

MESA Reference: Date of Certification:

4/15/2014

Cylinder-CGA: Analysis Method:

Cylinder Number:

A006-HP-BR/350 GC-TCD/FID

Recommended Shelf Life:

2 Years

Preparation Method:

Gravimetric

Component

Requested Concentration²

Reported Concentration^{2,3}

Ethylene Oxide Nitrogen

50 ppm Balance

48.8 ppm

Balance

Authorized Signature:

1. The fill pressure shown on the COA is as originally quoted. The fill pressure measured by the customer may differ from the lill pressure originally quoted due to temperature effects, compressibility of the individual components when blended together in the cylinder, gauge accuracy or reduction in content volume before shipping as a result of samples withdrawn for laboratory QC necessary to ensure product quality.

2. Unless otherwise stated, concentrations are given in molar units.

Vapor pressure mixes are hlended at a sufficiently low pressure so as to eliminate phase separation under most low temperature conditions encountered during transport or storage. However, it is generally recommended that cylinders containing vapor pressure restricted mixes be placed on the floor in a horizontal position and rolled back and forth to improve homogeneity of the gas phase mixture before being put into service.

Analytical Gas Standards are prepared and analyzed using combinations of NIST traceable weights, SRM's provided by NIST, or internal gas standards that have been verified for accuracy using procedures published by the US-EPA. Pure gases are analyzed and certified for purity using minor component Analytical Gas Standards prepared according to the methods specified above. Balances are calibrated to NIST test weights covered by NIST test number 822/256175/96. Reference Certification #'s: 163/W, 830/N and 3280. Calibration methods are in conformance with MIL-STD 45662A.

MESA Specialty Gaves & Equipment division of MESA International Technologies, Inc.

3619 Pendleton Avenue, Suite C + Santa Ana, California 92704 + USA TEL: 714-434-7102 • FAX: 714-434-8006 • E-mail: mail@mesagas.com On-line Catalog at www.mesagas.com

APPENDIX G

Process/Parametric Monitoring Data



Ceilcote Scrubber

Perform the following day of the Testing:

Testing Date 19 APR 16

Testing Start Time 10:00 am Testing Completed Time 11:10 am

- Run Cycle 751, in 3 chambers 2, 4, 6. Make sure cycle is loaded in Antares.
- Name of person doing the testing: DAN KREMER . Company ECSI
- ✓ Complete form G-F-EO-MNT-048
- ✓ Note glycol liquor level not to exceed 181.5": 181, 5 "
- V pH level: 0,73
- ✓ Liquor flow rate: 172.36 GPM.
- ✓ Glycol percent: 35.5 %. (Using Brix 50)
- ✓ Ship out 40 ml. glycol sample to CWM lab.
- ✓ Ship out truck load of glycol after the testing is complete. Date 19AR16 Approx. 5,000 Gals.
- ✓ Ship out 2nd shipment on Date 22 APR 16. Approx. 5,000 Gals.

Signature 20 APR 16



Weekly Preventive Maintenance - Acid Scrubbers (All Types)

		Inspectors Initials/Date
Check and record flow rate to Absorption Tower. Flow Rate = 172,36 Note: Acceptable Flow ranges - Environmental permit may dictate.	OK N/A C/A	21 19 AF
Perform alarm light test.	OKX N/A C/A	
Check the scrubber liquor and record the following values: Storage Tank level 181.5 (n) or Gal (If liquor is shipped for recycling, record in MP2) O.73 pH (Range ~ 0.5 to 1.0; Environmental permit may dictate)		
 Inlet Temperature 69 °F N/A - System does not monitor this parameter Outlet Temperature 67 °F N/A - System does not monitor this parameter 	OKX N/A C/A	
Note: Acceptable ranges - Environmental permit may dictate. System capabilities determine parameters Check all pumps, pipes, seals, and rings for leaks.	~	
Check pressure relief valve for leaks or discharge.	OKX N/A C/A	
Record Glycol concentration 35.5 %	OKX N/A C/A	
Note: Ensure concentration does NOT exceed permit conditions. Check scrubber EO Levels.	OKZTN/AC C/AC	V
Wet scrubber outlet/dry bed inlet PPM EO (High flow system only) Dry bed outlet PPM EO Note: If dry bed outlet concentration reaches permitted maximum levels make the necessary arrangement for dry bed absorbent replacement.	OK□ N/A⊠ C/A□	19 APR 16
 Write the scrubber type and number/location on the line provided above. If the inspection shows the Item does not need further inspection or attention then mark the [C] If a particular equipment item is not present, the inspector will mark the [N/A] Checkbox. If corrective action is required, mark the [C/A] Checkbox and then record the corrective action. Work Order number must be recorded below whenever possible. 		
CA - Corrective Action: (Include Item #, and action, i.e. W.O # or other)		

User must verify the revision number of printed or downloaded document against the effective version

Revision N°

Confidential Information

Page 1 of 1

Ceileate
F-Year feit
Emmission #1

STERIGENICS 5725 W. HAROLD GATTY DRIVE SALT LAKE CITY, UT 84116 (801) 328-9901 CHAMBER 4

CYCLE 751

DATE 04/19/16 Tue PROG VERSION KORSCP V3Q-4

RUN #

1714088

CUSTOMER

STERIGENICS

PRODUCT CUSTOMER LOT # N/A

CEILCOTE TEST

QUANTITY

N/A

CURRENT TANK: LOT # UTLX902437C16E001355, TARE 316.0 LB

SCALE WEIGHT 571.9 LB, STERILANT LEFT 250.9 LB

AATOR MATOR PROCESS PARAMETERS

CHAMBER TEMP 125 F, COOL AT 135 F, BLOWER IS USED, ALARM REPETITION 0:01 MM:SS

VACUUM A 2.0 INHGA, 2.01 INHG/MIN, REQD 3.0 INHGA

LEAK TEST 0:02 HH:MM, TOLERANCE 0.2 INHG

NITROGEN DILUTION 2 CYCLES; NITROGEN: 24.0 INHGA, 1.51 INHG/MIN

EVAC: 1.5 INHGA, 2.01 INHG/MIN

GAS A 1 CYCLES; INJ: 14.4 INHGA, 1.00 INHG/MIN, ED

GAS DWELL 14.4 INHGA, -0.2 INHG, DWELL 1:00 HH:MM

AFTER VACUUM 3.0 INHGA OR 0:45 HH:MM, 2.01 INHG/MIN, REQD 3.5 INHGA

GAS WASH A 3 CYCLES RLS: 23.0 INHGA, 1.51 INHG/MIN, NITR

> VAC: 3.0 INHGA OR 0:45 HH:MM, 2.01 INHG/MIN

Repart P

EO

-48771

STERILANT

OPERATOR AE

CHECK VALUE

REQD 3.5 INHGA

RLS: 23.0 INHGA, 1.51 INHG/MIN, AIR GAS WASH B 1 CYCLES

VAC: 3.0 INHGA OR 0:45 HH:MM, 2.01 INHG/MIN

REQD 3.5 INHGA

RELEASE 24.8 INHGA, 1.51 INHG/MIN

	PRESS	TEMP	(DEG F	F) RH	VAP									
TIME	INHGA		AVG	7.	GAS	-		ALARMS	& ME	SSAGES		CTION	TAKEN	
14:27			NSOR CH			87.5,	RH		JWT	130,	VLT	94,	VGX	121
	CT1	129,	CT2	130,	CT3	130,	PØ1	129,	P02	94,	PØ3	94,	PØ4	94
	PØ5	94,	P06	94,	P07	94,	PØ8	94,	PØ9	94,	P10	94,	P11	94
	P12	94,	P13	94,	P14	94,	P15	94,	P16	94,	P17	94,	P18	94
	P19	94,	P20	94,	ETO	ø,	H20	0.1,	WT	571.9		101 31091		
		13.4 C.10 4.1		VA	CUUM	A PHASE								
14:27	25.8		129		121									
14:28	23.7		129		121									
14:29	21.7		129		121									
14:30	OPERAT	OR SE	NSOR CH	HECK	PR	73.B,	RH	ø,	JWT	130,	VLT	94,	VGX	121
	CT1	128,	CT2	130,	CT3	130,	PØ1	128,	P02	94,	PØ3	94,	PØ4	94
	PØ5	94,	P06	94,	P07	94,	P08	94,	P09	100000000000000000000000000000000000000	P10	94,	P11	94
	P12	94,	P13	94,	P14	94,	P15	St. Contract of the	P16	4	P17	94,	P18	94
	P19	94,	P20	94,	ETO	ø,	H20	5	WT	571.9		W 534		
14:30	19.8		129		121	.		n karmure.₩						
14:31	17.B		129		121									

DDI ANTARES KORSCP V3Q-4 04/19/16 Tue 15:34 CYCLE 751 CHECK VALUE -48771 RUN # 1714088

165		1111000										
	PRESS	TEMP (DEG	F) RH VAP									
TIME	INHGA	AVG	≯ GAS			ALARMS	& ME	SSAGES	F	CTION	TAKEN	1

15:34	17.9	125	148									
15:35	15.9	124	146									
15:36	13.8	124	145									
15:37	11.8	124	144									
15:38	10.1	124	143									
15:39	8.4	123	142									
15:40	6.8	123	141									
15:41	5.5	123	140									
15:42	4.5	123	139									
15:43	3.7	123	138									
15:44	3.0	123	137									
15:45	OPERAT	OR SENSOR (CHECK PR	10.0,	RH	0,	JWT	123,	VLT	95,	VGX	137
	CT1	122, CT2	123, CT3	124,	PØ1	121,	P02	95,	PØ3	95,	PØ4	95
	P 0 5	95, P 0 6	95, P07	95,	PØ8	95,	PØ9	95,	P10	95,	P11	95
	P12	95, P13	95, P14	95,	P15	95,	P16	95,	P17	95,	P18	95
	P19	95, P20	95, ETO	Ø,	H20	0.1,	WT	572.3				
15:45	2.5	123	136									
15:46	2.1	123	135									
15:47	1.8	123	134									
15:48	1.5	123	134			- 10 14-		- 14:20				
15:48	1.5	123	134									
MAX:	24.0	128	149			1	PHASE	1:03	PHA9	E ELA		1:03
MIN:	1.5	123	109							C,	CLE	1:20
			GAS A	(EO) PHA	ASE							
15:48	1.5	123	134		3	=====		STERILAN	IT 1 ==			
15:49	2.6	123	133									
15:50	3.6	123	133									
15:51	4.6	123	134									
15:52	5.6	124	134									
15:53	6.6	124	134									
15:54	7.6	124	135									
15:55	8.6	124	134									
15:56	9.6	124	133			4						
15:57	10.7	124	131									
15:58	11.6	125	127									
15:59	12.6	125	123									
16:00	OPERAT	OR SENSOR C	CHECK PR	42.8,	RH	0,	JWT	126,	VLT	95,	VGX	123
	CT1	124, CT2	125, CT3	125,	PØ1	124,	P02	95,	P 0 3	95,	PØ4	95
	P05	95, P06	95, PØ7	95,	PØ8	95,	PØ9	95,	P10	95,	P11	95
	P12	95, P13	95, P14	95,	P15	95,	P16	The second of the second	P17	95,	P18	95
	P19	95, P20	95, ETO	ø,	H20	0.1,	WT	529.0				
16:00	13.6	125	120									
16:01		125	118									
	14.4	11.3	110									
755257												
MAX: MIN:	14.4	125 123	135 118			1	PHASE	0:12	PHAS	E ELAI	PSED CLE	0:12 1:33

DDI ANTARES KORSCP V3Q-4 04/19/16 Tue 16:02 CYCLE 751 CHECK VALUE -48771 RUN # 1714088

TIME	PRESS INHGA	TEMP (DEG F	F) RH	VAP GAS		1	ALARMS	& ME	SSAGES	A	CTION	TAKEN	1
			GAS	5 DWE	LL (E0)	PHAS	E						
16:02	14.4	125		117									
16:02	14.4	125		117						n	PERAT	אר בער	LE ABOR
6:02	14.4	125		117			SHORT E	YDOG	IRE	-		JIV G16	LL HOUN
16:02	14.4	125		117			OHOINI L	. AT UU	BKL				
MAX:	14.4	125		117			F	HASE	0:00	PHAS	e elaf	PSED	0:00
MIN:	14.4	125		117								YCLE	1:35
			AF	TER V	ACUUM F	PHASE							
16:02	14.4	125		117									
16:03		OR SENSOR CH	HECK	PR	43.1,	RH	ø,	JWT	126,	VLT	95,	VGX	116
	CT1	124, CT2	126,	CT3	125,	PØ1	124,	P02		P03	95,	PØ4	95
	P05	95, PØ6	95,	P07	95,	PØ8	95,	PØ9	95,	P10	95,	P11	95
	P12	95, P13	95,	P14	95,	P15	95,	P16	95,	P17	95,	P18	95
	P19	95, P20	95,	ETO	ø,	H20	0.1,	WT	520.5				- 5.00
16:03	12.2	125	1000000	116									
6:04	10.3	125		116									
17:05	8.7	125		116									
.06	7.2	124		117									
6:07	6.0	124		117									
16:08	5.1	124		117									
6:09	4.3	124		117									
6:10	3.7	124		118									
6:11	3.2	124		118									
16:12	3.0	124		118			EVACUAT	ION	PRESSURE				
16:12	3.0	124		118									
MAX:	14.4	125		118			F	HASE	0:09	PHAS	E ELAF	PSED	0:09
MIN:	3.0	124		116							C	YCLE	1:44
			GAS	S WAS	н а РНА	YSE							
16:12	3.0	124		118				====	RELEASE	1 ====	=====		
16:12	3.2	124		118						0	PERATO	OR CYC	LE STOP
16:13	3.4	124		117									
16:13	3.4	124		117						C	YCLE (CONTIN	IUED
16:14	5. 1	124		116									
16:15	6.5	124		116									
16:16	8.0	124		117									
16:17	9.6	125		119									
16:18	11.0	125		122									
16:19	12.6	125		125									
20	14.1	125		128									
16:21	15.6	125		131									
16:22	17.1	125		134									
16:23	18.6	125		136									
16:24	20.1	126		138									

Cedloute fact

STERIGENICS 5725 W. HAROLD GATTY DRIVE SALT LAKE CITY, UT 84116 (801) 328-9901 CHAMBER 2

CYCLE 751

DATE 04/19/16 Tue PROG VERSION KORSCP V3Q-4 4 NUS

1714091

CUSTOMER PRODUCT

STERIGENICS

N/A

CEILCOTE TEST

PLITABUS

SUSTOMER LOT #

N/A

CURRENT TANK: LOT # UTLX902437C16E001314, TARE 301.0 LB CALE WEIGHT 699.7 LB, STERILANT LEFT 393.7 LB

PROCESS PARAMETERS

CHAMBER TEMP 125 F, COOL AT 135 F, BLOWER IS USED, ALARM REPETITION 0:01 MM:SS

VACUUM A 2.0 INHGA, 2.01 INHG/MIN, REQD 3.0 INHGA

LEAK TEST 0:02 HH:MM, TOLERANCE 0.2 INHG

NITROGEN DILUTION 2 CYCLES; NITROGEN: 24.0 INHGA, 1.51 INHG/MIN

EVAC: 1.5 INHGA, 2.01 INHG/MIN

GAS A 1 CYCLES; INJ: 14.4 INHGA, 1.00 INHG/MIN, ED

GAS DWELL 14.4 INHGA, -0.2 INHG, DWELL 1:00 HH:MM

AFTER VACUUM 3.0 INHGA DR 0:45 HH:MM, 2.01 INHG/MIN, REQD 3.5 INHGA

GAS WASH A 3 CYCLES RLS: 23.0 INHGA, 1.51 INHG/MIN, NITR

VAC: 3.0 INHGA OR 0:45 HH:MM, 2.01 INHG/MIN

RECARRILLE WAYEN

EO

-48771

STERILANT

OPERATOR AE

CHECK VALUE

pe rappeals

REQD 3.5 INHGA

GAS WASH B 1 CYCLES RLS: 23.0 INHGA, 1.51 INHG/MIN, AIR

> VAC: 3.0 INHGA OR 0:45 HH:MM, 2.01 INHG/MIN

> > REQD 3.5 INHGA

RELEASE 24.8 INHGA, 1.51 INHG/MIN

52122467544	PRESS	TEMP	(DEG		VAP									
TIME	INHGA		AVG	1/-	GAS			ALARMS	& ME	SSAGES	F	ACTION	TAKEN	
15:01	OPERAT	OR SE	NSOR (CHECK	PR	87.4,	RH	ø,	JWT	135,	VLT	95,	VGX	127
	CT1	129,	CT2	130,	CT3	129,	PØ1	130,	P02	95,	P03	95,	PØ4	95
	P05	95,	P06	95,	P07	95,	P08	95,	PØ9	95,	P10	95,	P11	95
	P12	95,	P13	95,	P14	95,	P15	95,	P16	95,	P17	95,	P18	95
	P19	95,	P20	95,	ETO	0,	H20	0.1,	WT	699.7		-2020-in		
					CUUM	THE PROPERTY OF THE PARTY OF TH								
15:01	25.8		129		127									
15:02	OPERAT	OR SE	NSOR (CHECK	PR	86.9,	RH	ø,	JWT	135,	VLT	95,	VGX	127
	CT1	129,	CT2	130,	CT3	129,	P01	130,	P02	95,	P03	95,	P@4	95
	PØ5	95,	P06	95,	PØ7	95,	PØ8	95,	PØ9	95,	P10	95,	P11	95
	P12	95,	P13	95,	P14	95,	P15	95,	P16	95,	P17	95,	P18	95
	P19	95,	P20	95,	ETO	Ø,	H20	0.1,	WT	699.7		11.555		
102	23.7		129		127									
15:03	21.7		129		127									
15:04	19.7		129		127									
15:05	17.7		128		127									

DDI ANTAF RUN #	RES KORS	CP V3Q-4 1714091	04/19/16 Tu	e 16:40	CYCL	E 751	CHECK	VALUE -4	9771
77		Vantarentiarit substance ter	W Marke Market						
TIME	PRESS	TEMP (DEG F			al anua e		-		
TIME	INHGA	AVG	≯ GAS	WORK THE STATE OF	ALARMS & I	MESSAGES	AC	TION TAKE	N
16:40	13.7	126	127						
16:40	14.4	126	126						
		460	TLU						
MAX:	14.4	126	134		PHAS	SE 0:12	PHASE	ELAPSED	0:12
MIN:	1.5	125	126					CYCLE	1:38
	STERTL	ANT USED THI	S PHASE:	50.4, C	YCLE TOTAL:	50.4			
			GAS DWEL	L (ED) PH	ASE				
16:41	14.5	126	124						
	14.4	126	124				QD	ERATOR CYC	CLE ABORT
16:42		126	124		SHORT EXP	OSURE			
16:42	14.4	126	124						
MOV.	44 E	100	464				Name of the Control o	. 10000000 1000000000000000000000000000	
MAX: MIN:	14.5 14.4	126 126	124		PHAS	SE 0:00	PHASE	ELAPSED	0:00
14114	14.4	156	124					CYCLE	1:40
			AFTER VA	CUUM PHASI	=			_	
	12.2	V-2-2-1	10202						
42 16:42	14.4	126	124	/ C . C . D.			CARROTTE C		1400000000
16:46	CT1	OR SENSOR CH							124
		TO:		126, P0:				96, P04	96 96
				96, P1				96, P18	96
	P19		96, ETO	0, H20		649.3		50, 110	30
16:43	12.9	126	122	# - • 3 # 3 H2 - 3 × 5					
16:44	11.0	126	122						
	10.9	126			SLOW EVAC	JATION			
16:45	9.5	126	122						
16:46 16:47	8.2 7.1	125 125	122 122						
16:48	6.2	125	123						
16:49	5.3	125	123						
16:50	4.7	125	123						
16:51	4.0	125	123						
16:52	3.5	125	123						
16:53	3.1	124	123						
16:53 16:53	3.0	124 124	123 123		EVACUATION	N PRESSURE	3		
10.55	3.0	164	123						
MAX:	14.4	126	124		PHAS	SE 0:11	PHASE	ELAPSED	0:11
MIN:	3.0	124	122			200	1.100	CYCLE	
			GAS WASH	A PHASE					
16:53	3.0	124	123		========	DEL EACE	1 =====		
on the se and had		A L. T				WELEHOE	7		
16:54	4.7	125	122						

Leilcot Lest

STERIGENICS 5725 W. HAROLD GATTY DRIVE SALT LAKE CITY, UT 84116 (801) 328-9901 CHAMBER 6

DATE 04/19/16 Tue PROG VERSION KORSCP V3Q-4

1714098

CYCLE 751

USTOMER

UN #

STERIGENICS

RODUCT

N/A

CEILCOTE TEST

UANTITY

USTOMER LOT #

N/A

URRENT TANK: LOT # UTLX902437C16E000959, TARE 308.0 LB CALE WEIGHT 635.6 LB, STERILANT LEFT 322.6 LB

Repair Market STERILANT ED CHECK VALUE -48771

ACARPIC ARPLE

PROCESS PARAMETERS

CHAMBER TEMP 125 F, COOL AT 135 F, BLOWER IS USED, ALARM REPETITION 0:01 MM:SS

VACUUM A 2.0 INHGA, 2.01 INHG/MIN, REQD 3.0 INHGA

LEAK TEST 0:02 HH:MM, TOLERANCE 0.2 INHG

NITROGEN DILUTION 2 CYCLES: NITROGEN: 24.0 INHGA, 1.51 INHG/MIN EVAC: 1.5 INHGA, 2.01 INHG/MIN

> GAS A 1 CYCLES: INJ: 14.4 INHGA, 1.00 INHG/MIN, EO

GAS DWELL 14.4 INHGA, -0.2 INHG, DWELL 1:00 HH:MM
AFTER VACUUM 3.0 INHGA OR 0:45 HH:MM, 2.01 INHG/MIN, REQD 3.5 INHGA

GAS WASH A 3 CYCLES RLS: 23.0 INHGA, 1.51 INHG/MIN, NITR

VAC: 3.0 INHGA OR 0:45 HH:MM, 2.01 INHG/MIN

REQD 3.5 INHGA

GAS WASH B 1 CYCLES RLS: 23.0 INHGA, 1.51 INHG/MIN, AIR

> 3.0 INHGA OR 0:45 HH:MM, 2.01 INHG/MIN VAC:

> > REQD 3.5 INHGA

RELEASE 24.8 INHGA, 1.51 INHG/MIN

	PRESS	TEMP	(DEG	F) RH	VAP									
TIME	INHGA		AVG	*	GAS			ALARMS	& ME	SSAGES		ACTION	TAKEN	
15:06	OPERAT	OR SE	NSOR	CHECK	PR	87.6.	RH	ø,	JWT	135,	VLT	96,	VGX	121
	CT1	127,	CT2		CT3	129,	PØ1	128,	P02		PØ3	96,	PØ4	96
	PØ5	96,	P06		P07	96,	P08	96,	PØ9	95,	P10	96,	P11	96
	P12	96,	P13		P14	96,	P15	96,	P16		P17	96,	P18	96
	P19	96,	P20	20	ETO	0,	H2O	0.1,	WT	635.6				
		170		VA	CUUM	A PHASE		THE DOOR !						
15:06	25.9		128		121									
15:06	OPERAT	OR SE	NSOR	CHECK	PR	87.6,	RH	0,	JWT	135,	VLT	96,	VGX	121
	CT1	127,	CT2	128,	CT3	129,	P01	128,	PØ2		PØ3	96,	PØ4	96
	P05	96,	P06	96,	P07	96,	PØ8	96,	PØ9		P10	96,	P11	96
	P12	96,	P13	96,	P14	96,	P15	96,	P16	96,	P17	96.	P18	96
	P19	96,	P20	96,	ETO	0,	H20	0.1,	WT	635.6				
15.07	23.7		128		121									
15:08	21.7		128		121									
15:09	19.7		127		121									

DI ANTARES KORSCP V3Q-4 04/19/16 Tue 16:36 CYCLE 751 CHECK VALUE -48771 !UN # 1714098

JUIN 19		1714030						
	PRESS	TEMP (DEG F)	RH VAP					
TIME	INHGA	AVG	% GAS	ALARMS & MESSAGES ACTION TAKEN				
			ALCERTAL TAX TAXABLE TA CONTROL					
GAS A (EO) PHASE								
16:36	1.5	124	100	PTENTIONE				
16:37	2.7	125	126 123	======= STERILANT 1 ===========				
16:38	3.7	125						
16:39	4.7		121					
16:40	5.7	125 125	120					
16:41	6.7	125	119					
16:42	7.7	125	120					
16:43	8.7	126	121 122					
16:44	9.7	126	124					
16:45	10.8	126	125					
16:46	11.7	126	127					
16:47	12.7	126	128					
16:48	13.7	126	129					
16:49	14.4	126	129					
	* **	120	11.3					
MAX:	14.4	126	129	PHASE 0:12 PHASE ELAPSED 0:12				
MIN:	1.5	124	119	CYCLE 1:42				
		12010						
STERILANT USED THIS PHASE: 49.6, CYCLE TOTAL: 49.6 GAS DWELL (EO) PHASE								
				1				
16:50	14.5	126	130					
16:51	14.5	126	130					
16:52	14.5	126	129					
16:53	14.5	126	129					
16:54	14.5	126	129					
16:55	14.5	126	128					
16:56	14.5	125	128					
16:57	14.5	125	128					
16:58	14.5	125	128	OPERATOR CYCLE ABORT				
16:58 16:58	14.5 14.5	125	128	SHORT EXPOSURE				
10:30	14.0	125	128					
MAX:	14.5	126	130	PHASE 0:07 PHASE ELAPSED 0:07				
MIN:	14.5	125	128	CYCLE 1:51				
1100-00-00		2,520	1120	CICLE 1.31				
			AFTER VACUUM F	HASE				
16:58	14.5	125	128					
16:59	12.B	125	127					
17:00	11.1	125	126					
17:00	10.9	125	126	SLOW EVACUATION				
1 0		OR SENSOR CHEC		RH 0, JWT 130, VLT 96, VGX 126				
	CT1		25, CT3 125,	P01 125, P02 96, P03 96, P04 96				
	P05		96, PØ7 96,	P08 97, P09 96, P10 96, P11 96				
	P12		96, P14 96,	P15 96, P16 96, P17 97, P18 96				
	P19	96, P20	96, ETO 0,	H2O 0.1, WT 586.3				

DI ANTARES KORSCP V3Q-4 04/19/16 Tue 17:01 CYCLE 751 CHECK VALUE -48771 UN # 1714098

UN :#		1714030		
	PRESS	TEMP (DEG F)	RH VAP	
TIME	INHGA	AVG	% GAS	ALARMS & MESSAGES ACTION TAKEN
		10111-1011		
17:01	9.6	124	126	
17:02	8.3	124	126	
17:03	7.3	124	125	
17:04	6.3	124	125	
17:05	5.6	124	125	
17:05	4.B	124	125	
17:07	4.3	124	124	
17:08	3.8	124	124	
17:09	3.4	124	124	
17:10	3.0	124	123	EVACUATION PRESSURE
17:10	3.0	124	123	
MAY.	1/. =	105	100	PHASE 0:11 PHASE ELAPSED 0:11
MAX: MIN:	14.5	125 124	128 123	CYCLE 2:03
PILINE	3.0	164	153	CTOLE E.00
			GAS WASH	I A PHASE
17:10	3.0	124	123	======= RELEASE 1 ==============
17:11	4.5			
17:12	6.0	125	123	
17 13	7.5	125	124	
1 .4	9.0	125	126	
17:15	10.5	125	128	
17:16	12.0	125	130	
17:17	13.5	126	132	
17:18	15.0	126	134	
17:19	16.5	126	136	
17:20	18.0	126	138	
17:21	19.5	126	139	
17:22	20.9	126	140	
17:23	22.4	126	141	
17:23	23.0	126	141	======= EVACUATION 1 ===========
17:24	21.5	126	141	
17:25	19.6	126	141	
17:26	17.8	125	140	
17:27	15.9	125	139	
17:28	14.0	125	138	
17:29	12.2	125	137	
17:30	10.5	125	136	
17:31	9.1	124	135	
17:32	7.9	124	134	
17:33	6.8	124	133	
17:34	5.8	124	132	
17:35	5.0	124	131	
17:36	4.3	124	131	
17:37	3.7		130	
1 . 8	3.2		129	
17:3B	3.0		129	EVACUATION PRESSURE
17:38	3.0		129	======= RELEASE 2 ============
17:39	3.8		129	
17:40	5.2		131	
17:40	5.9		132	SLOW INJECTION